Raytheon Company

Transmittal No. W204984

IWPS MEC Process Description

The MEC Wastewater Treatment Facility is designed to treat approximately 187,000 gal of wastewater per day. The wastewater is the combination of spent Acids, Alkalines and Rinse Waters generated from semiconductor Research and Development operations and D.I. Water Mixed Bed regeneration. The MEC Treatment Facility consists of Flow Equalization, Two stage pH Neutralization and Final Effluent monitoring. In addition, the treatment system is equipped with automatic diversion controls designed to help eliminate Final Effluent pH excursions. The treatment plant is designed for continuous operation and requires minimal operator interface. The treatment process is described as follows.

Influent Wastewater, from the various point sources, flows by gravity into a recessed Transfer Sump. This is the centralized collection point for all Wastewater. Once this tank becomes full, the contents are automatically pumped into the Flow Equalization Tank (E.Q.).

The E.Q. Tank is the heart of this treatment process. It is designed to match E.Q. Tank discharge to its Influent Flow rate. System control is done through an Ultrasonic Level Detection device and an electronic actuated Diaphragm Valve. As the level in the E.Q. Tank increases or decreases instrumentation automatically modulates the Diaphragm Valve Open or Closed accordingly.

Effluent, pumped from the E.Q. Tank, flows into the 1st Stage pH Reactor. Here, Wastewater is neutralized, to a pH of 6 to 9, with Sodium Hydroxide or Sulfuric Acid. Effluent, from the 1st Stage, is polished in the 2nd Stage pH Reactor using identical treatment chemistry as the previous stage. Treated Effluent, from this system, flows through a Trapezoidal Flume where pH and flow are continuously measured and recorded. Final effluent is discharged to the GLSD.

Raytheon Company

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IWPS MMIC Process Description

The MMIC Gallium Arsenide Treatment System is designed to treat approximately 64,800 gal of wastewater, per day, from the Semiconductor Manufacturing Facility at Raytheon Company. Wastewater, from this facility is segregated into two waste streams, Arsenic bearing and non-Arsenic bearing, each with its own treatment process.

Arsenic bearing wastewater is the combination of spent Acids, Bases, and Rinse Waters generated from etching, grinding, dicing, and cleaning operations. The facility designation for this waste stream is Special Acid Waste (S.A.W.). The S.A.W. treatment system includes Flow Equalization, Arsenic Reduction, Hydroxide Precipitation, and Ultra filtration. In addition, the system is equipped with a diversion tank capable of collecting S.A.W. during treatment upsets or system maintenance. This flow through system's capable of treating 11,500 gal of Wastewater per day. The treatment process is described as follows.

Influent flow, from the various S.A.W. point sources, is either pumped or gravity drained into a collector tank referred to as the Filtration Feed Sump. This sump provides flow equalization so that the down stream filtration unit (Memtek) can be fed at a specific flow rate regardless of production discharge irregularity. Wastewater is pumped from this feed sump at a system specific flow rate of 8 gpm into the first of three pre-treatment tanks.

In the first reaction tank, Arsenic is reduced from the Pentavalent form (As +5) to the Trivalent form (As +3) by adjusting the Wastewater pH between 3.5 to 4.5 with Sodium Hydroxide or Sulfuric Acid while simultaneously adding a reducing agent, Ferric Chloride. The reducing agent is metered into the system as to maintain a 10:1 ration of Iron to Arsenic. The reduction continues in the second reaction tank. This tank provides additional reaction time to ensure that the Arsenic reduction is complete. In the third and final reaction tank, an Iron Hydroxide Precipitant is formed by adjusting the solution pH, between 8 to 8.5 with Sodium Hydroxide. It is critical that the pH of the Wastewater discharging from this reactor doesn't drop below 7.5 otherwise Arsenic will begin to resolubilize.

At the completion of pre-treatment the newly formed wastewater precipitant flows into the filtration system Concentrate Tank. This tank serves as the pivot point for filtration membrane module recirculation. Wastewater is recycled out of this tank and through the filtration module train by means of a pump referred to as the Process Pump. Mechanically induced back pressure allows that portion of Wastewater, with particle size less than 0.1 micron, to pass through the filter membrane. This fluid, known as Filtrate, is combined downstream, with other non Arsenic bearing wastewater for future treatment. The captured portion, known as Concentrate, is returned back into the Concentrate Tank..

Over time, Suspended Solids will exceed the targeted concentration set point, which for this system is 1 percent, and therefore will need to be removed. Removal is done by withdrawing equal portions of the concentrated material through a Filter Press. Once dewatered, the solids are shipped offsite for disposal. Periodic testing must be performed to ensure that solids concentration remain consistent with operating parameters.

Occasionally the Ultra Filters will require maintenance. Over time membrane pours become blinded with Iron Hydroxide and, therefore, need to be cleaned. Following removal for this system is done with a 10 percent Hydrochloric Acid Solution soak. The membrane train is filled with this cleaning solution and allowed to soak for a specific duration. At the end of the soak, the membranes are rinsed and neutralized and the system is put back into service.

Non arsenic bearing wastewater consists of concentrated Acids and Bases, used in semiconductor cleaning, and the associated Rinse Waters from these and other cleaning processes. The facility designation for this waste stream is Regular Acid Waste (R.A.W.).

The R.A.W. treatment system consists of Two Stage pH Neutralization and Final Effluent monitoring. In addition, the system is designed with diversion controls that will automatically transform the two stage system to a single stage treatment process or by pass the system entirely into a separate collection tank during events of treatment upsets or system maintenance. This flow through system is capable of treating 45,000 gal of Wastewater per day. The treatment process is described as follows:

Influent flow is either pumped or gravity drained, from various R.A.W. point sources throughout the Wafer Fab, into the Neutralization Feed Sump. This collection sump is the transfer point of process flow into the Neutralization System. Wastewater is pumped from this sump into the 1st Stage pH Reactor. Here, Wastewater is neutralized to a pH of 6 to 9 with Sodium Hydroxide or Sulfuric Acid. Effluent, from the 1st Stage, is polished in the 2nd Stage pH Reactor using identical treatment technology as the previous stage. Treated effluent, from the system, flows through a Parshall Flume where pH and flow are continuously measured and recorded. Final effluent is discharged to the Greater Lawrence, Mass. Sanitary District.

As mentioned, the R.A.W. system is designed with automatic pH reactor by passes to help prevent a Final Effluent pH excursion in the event of a mixer or pH controller failure.

For 1st Stage failures, Influent flow is directed into the second stage. For 2nd Stage failures, 1st Stage Effluent is diverted into the Final Effluent Flume. If for some reason those safe guard fail and the Final Effluent exceeds alarm set points, the system will direct Wastewater into a separate collection tank until which time the treatment upset can be rectified.

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IWPS MMIC Process Description

The MMIC Gallium Arsenide Treatment System is designed to treat approximately 64,800 gal of wastewater, per day, from the Semiconductor Manufacturing Facility at Raytheon Company. Wastewater, from this facility is segregated into two waste streams, Arsenic bearing and non-Arsenic bearing, each with its own treatment process.

Arsenic bearing wastewater is the combination of spent Acids, Bases, and Rinse Waters generated from etching, grinding, dicing, and cleaning operations. The facility designation for this waste stream is Special Acid Waste (S.A.W.). The S.A.W. treatment system includes Flow Equalization, Arsenic Reduction, Hydroxide Precipitation, and Ultra filtration. In addition, the system is equipped with a diversion tank capable of collecting S.A.W. during treatment upsets or system maintenance. This flow through system's capable of treating 11,500 gal of Wastewater per day. The treatment process is described as follows.

Influent flow, from the various S.A.W. point sources, is either pumped or gravity drained into a collector tank referred to as the Filtration Feed Sump. This sump provides flow equalization so that the down stream filtration unit (Memtek) can be fed at a specific flow rate regardless of production discharge irregularity. Wastewater is pumped from this feed sump at a system specific flow rate of 8 gpm into the first of three pre-treatment tanks.

In the first reaction tank, Arsenic is reduced from the Pentavalent form (As +5) to the Trivalent form (As +3) by adjusting the Wastewater pH between 3.5 to 4.5 with Sodium Hydroxide or Sulfuric Acid while simultaneously adding a reducing agent, Ferric Chloride. The reducing agent is metered into the system as to maintain a 10:1 ration of Iron to Arsenic. The reduction continues in the second reaction tank. This tank provides additional reaction time to ensure that the Arsenic reduction is complete. In the third and final reaction tank, an Iron Hydroxide Precipitant is formed by adjusting the solution pH, between 8 to 8.5 with Sodium Hydroxide. It is critical that the pH of the Wastewater discharging from this reactor doesn't drop below 7.5 otherwise Arsenic will begin to resolubilize.

At the completion of pre-treatment the newly formed wastewater precipitant flows into the filtration system Concentrate Tank. This tank serves as the pivot point for filtration membrane module recirculation. Wastewater is recycled out of this tank and through the filtration module train by means of a pump referred to as the Process Pump. Mechanically induced back pressure allows that portion of Wastewater, with particle size less than 0.1 micron, to pass through the filter membrane. This fluid, known as Filtrate, is combined downstream, with other non Arsenic bearing wastewater for future treatment. The captured portion, known as Concentrate, is returned back into the Concentrate Tank..

Over time, Suspended Solids will exceed the targeted concentration set point, which for this system is 1 percent, and therefore will need to be removed. Removal is done by withdrawing equal portions of the concentrated material through a Filter Press. Once dewatered, the solids are shipped offsite for disposal. Periodic testing must be performed to ensure that solids concentration remain consistent with operating parameters.

Occasionally the Ultra Filters will require maintenance. Over time membrane pours become blinded with Iron Hydroxide and, therefore, need to be cleaned. Following removal for this system is done with a 10 percent Hydrochloric Acid Solution soak. The membrane train is filled with this cleaning solution and allowed to soak for a specific duration. At the end of the soak, the membranes are rinsed and neutralized and the system is put back into service.

Non arsenic bearing wastewater consists of concentrated Acids and Bases, used in semiconductor cleaning, and the associated Rinse Waters from these and other cleaning processes. The facility designation for this waste stream is Regular Acid Waste (R.A.W.).

The R.A.W. treatment system consists of Two Stage pH Neutralization and Final Effluent monitoring. In addition, the system is designed with diversion controls that will automatically transform the two stage system to a single stage treatment process or by pass the system entirely into a separate collection tank during events of treatment upsets or system maintenance. This flow through system is capable of treating 45,000 gal of Wastewater per day. The treatment process is described as follows:

Influent flow is either pumped or gravity drained, from various R.A.W. point sources throughout the Wafer Fab, into the Neutralization Feed Sump. This collection sump is the transfer point of process flow into the Neutralization System. Wastewater is pumped from this sump into the 1st Stage pH Reactor. Here, Wastewater is neutralized to a pH of 6 to 9 with Sodium Hydroxide or Sulfuric Acid. Effluent, from the 1st Stage, is polished in the 2nd Stage pH Reactor using identical treatment technology as the previous stage. Treated effluent, from the system, flows through a Parshall Flume where pH and flow are continuously measured and recorded. Final effluent is discharged to the Greater Lawrence, Mass. Sanitary District.

As mentioned, the R.A.W. system is designed with automatic pH reactor by passes to help prevent a Final Effluent pH excursion in the event of a mixer or pH controller failure.

For 1st Stage failures, Influent flow is directed into the second stage. For 2nd Stage failures, 1st Stage Effluent is diverted into the Final Effluent Flume. If for some reason those safe guard fail and the Final Effluent exceeds alarm set points, the system will direct Wastewater into a separate collection tank until which time the treatment upset can be rectified.

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1.0 IWPS IADC PROCESS DESCRIPTION

The IADC Wastewater Treatment Plant is designed to treat a maximum flow of 72,000 gallons per day. The average daily flow is 17,000 gallons. The wastewater is generated from Chromium Conversion Plating, Printed Circuit Card Cleaning, Aluminum Deburring, and from various testing and research laboratories. The wastewater is segregated into two waste streams, Chromium bearing and Non Chromium bearing, each with its own treatment scheme. All of the wastewater is pumped, through lift stations, to the treatment facility. The treatment facility includes Flow Equalization, Chromium Reduction, Two Stage pH Neutralization, Metal Precipitation/Clarification, Final pH polishing, and Final Effluent monitoring. The treatment process is described as follows.

All of the non bearing Chromium influent is pumped into a 3000 gallon Equalization Tank. This tank provides a buffer zone for process flow inequity and controls the feed to upstream treatment tanks. The tank is equipped with an Ultrasonic level device designed to adjust E.Q. Pump motor speed to tank level. The operating level of the E.Q. tank is set to a specific set point. As the level deviates from the set point instrumentation automatically adjusts E.Q. pump motor speed accordingly. The tank is equipped with two pumps that are manually alternated weekly. Each pump is equipped with a suction strainer designed to capture coarse solids before they reach the pump volute. They are cleaned on pressure differential. Antifoam is automatically metered into this tank to help prevent foam from interfering with sonar level instrumentation. The E. Q. tank functions as a divert tank as well. The Two Stage pH system, pH Polisher, and Final Effluent are all wired back into the E.Q. control panel. In the event of one of these systems alarming, the E.Q. pumps will automatically shut down. The E.Q. level control point is set such that sufficient storage capacity is provided until the upstream issue is rectified.

Chrome bearing wastewaters are generated from a Chromium Conversion plating operation. Rinses, from this line, gravity flow into a single collection sump. This sump operates similar to the E.Q. tank except instrumentation modulates a valve instead of controlling pump speed. The sump discharges wastewater into the Chrome reactor. This flow through reactor uses standard O.R.P. control for Chromium reduction. The pH is adjusted to a set point of 2.50 using 98% Sulfuric Acid and the addition of 38% Sodium Metabisulfite is utilized to reduce the Chrome state.

Effluent from the Chrome reactor and E.Q. tank discharges into the 1st Stage pH reactor. In this tank, wastewater is neutralized to a pH of 6 to 9 using 50% Sodium Hydroxide and 98% Sulfuric Acid. Effluent from the 1st stage, gravity flows into the 2nd Stage pH reactor where the pH is polished using identical chemistry as in the previous stage. Both reactors are designed for continuous flow. Neutralized effluent flows into a Flocculation tank. This tank provides front end treatment for the Clarifier. The tank is designed for the addition of Coagulant and Flocculants chemistry to conglomerate suspended matter and enhance settling in the Clarifier. The Clarifier, a Lamella

separator, is equipped with a series of stacked inclined plates designed to reduce flow velocity and provide large surface area for solids to settle onto. The solids that are captured slide from these plates into the collection hopper. The clarified effluent discharges into a pH Polishing tank. This tank polishes the wastewater to a pH set point of 8.5 using 50% Sodium Hydroxide and 98% Sulfuric Acid. System effluent is pumped through an Effluent Monitoring Station, where pH and flow are continuously measured and recorded. A Magnetic Flow meter is used to measures flow. The effluent is discharged to the Greater Lawrence Sanitary District. The Metal Hydroxide sludge that is captured in the Clarifier is periodically pumped to the Filter Press Feed Tank. From here, the sludge is dewatered through a Filter Press. The filtrate is sent back through the system influent while the sludge is shipped offsite for disposal.

The system is also equipped with a 20,000 gallon divert tank. This tank is utilized during major system upsets. It is manually activated by the duty operator. It has the capability of storing 18 to 24 hours of continuous flow. This system is equipped to batch treat concentrated Acid and Alkaline by-products from the Chromium Conversion line. Both 98% Sulfuric Acid and 50% Sodium Hydroxide are used in the neutralization process while Sodium Hydrosulfite is used for Chrome reduction. The treated concentrate is pumped to a Sludge Decant tank. Here, the Metal Hydroxide precipitant is allowed to settle. The clear water is decanted back through the system and the solids portion is dewatered through the Filter Press.